Fluid Mechanics.

11/10/2015
محاضرة (1) ميكانيكا موائع
AMR
M.r
1

★ Fluid : any substance that deforms contuiously under application of shear strees, no matter how small shear stress may be.

أي مادة تتشكل باستمرار تحت تأثير إجهادات القص. مهما كانت هذا الإجهاد صغير.

★ Mechanics :

هو العلم الذي يختص بدراسة سلوك المواد تحت تأثير القوى المختلفة.

- dynamics: $\Sigma F = ma$
- static: $\Sigma F = 0$.

★ Fluid Mechanics :- هو العلم الذي يهتم بدراسة المواد التي تشكل تحت تأثير إجهاد القص وذلك مع القوى المختلفة.

★ Fluid static : $\Sigma F = 0$

★ Fluid dynamics : $\Sigma F = ma$

★ Application of Fluid Mechanics.

↳ breathing - blood flow - pump - turbine - Fan

boiler - river - ships - .....

(b)

★ stress $= \dfrac{F}{A}$

★ normal stress $= \dfrac{F_n}{A}$

(pressure) القوة العمودية على السطح .

★ Tangential stress $= \dfrac{F_t}{A}$

(shear stress) القوة المماسية للسطح .

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1 Difference between (solid - Fluid)

* حيث يحدث للمواد الصلبة عملية كسر.

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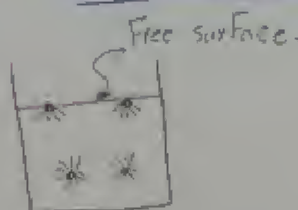
2 Difference between (solid - liquid - gas)

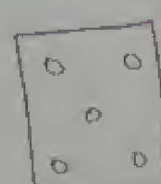
solid.

المسافات البينية لذرات صغيرة جدا
قوى الترابط بينهم كبيرة جداً.



liquid

المسافات البينية لذرات كبيرة
نسبياً وقوى الترابط بين
الذرات متوسطة.



Gas

المسافات البينية لذرات
كبيرة جداً وقوى ترابط
بين الذرات صغيرة
جداً.

C

★ Difference between (liquid and gas)

	liquid	gas
① ★ distance between Moleceuse. (المسافة بين الجزيئات)	Very small	very Large
② ★ compressiblity. (الإنضغاطية)	diffieult to compress.	easy to compress.
③ ★ Volume.	has a fixed volume it takes the shape of the container.	Not Fixed volume it expand to fill the container.
④ ★ Free surface.	✓	X

Gas.

- Compressible.
- In compressible ($M \leq 0.3$)

Mach number ⟶ $(M) = \frac{V}{a}$

- V ⟶ سرعة المائع.
- a ⟶ سرعة الصوت.

★ $M = 1$ ⟶ $(V = a)$ ⟶ Sonic Flow.

★ $M < 1$ ⟶ $(V < a)$ ⟶ sub sonic Flow.

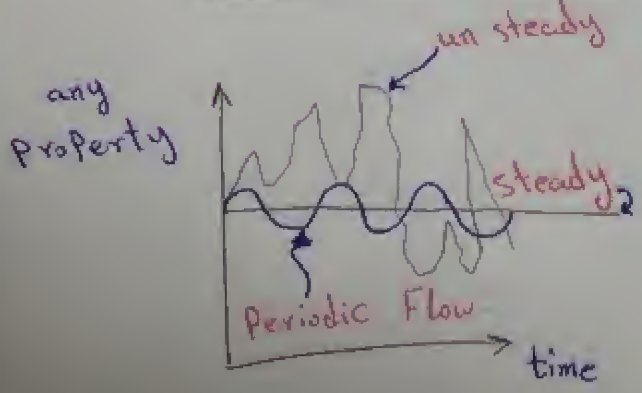
★ $M > 1$ ⟶ $(V > a)$ ⟶ super sonic Flow.

d

* steady Flow : الخواص للسريان لاتتغير مع الزمن.

* uniform Flow : الخواص لاتتغير مع المكان.

	①	②
steady uniform.	50 50 50	50 50 50
steady non uniform.	50 70 50	50 60 50
un steady uniform.	50 60 90	50 60 90
un steady. non uniform.	50 70 100	100 120 130



Sheet (1)

Introduction and Basic Concepts

1- Fill in the blanks with suitable words:

a) Fluids cannot withstand _____.
b) Fluids _____ to deform when a shear force is applied.
c) The atoms/molecules are _____ to move in fluids.
d) In liquids _____ is proportional to shear stress.
e) The difference between liquids and gases is _____.
f) Liquids form a Free surface when in a container.
g) Gases expand to Fill the container.
h) The distance between molecules is highest in Gass
i) The three phases of matter are solid - liquid - gas
j) A special state of matter at high temperatures is Plasma.
k) Fluid mechanics: The science that deals with the behavior of fluids at rest (Fluid static) or in motion (Fluid dynamic), and the interaction of fluids with solids or other fluids at the boundaries.
l) In analyzing the behavior of fluids, there are two such entities are defined namely compresibile and the Incompresibile
m) A volume defined in space through which fluid may flow with varying mass and volume is called a system, and its boundaries called boundry.

2- Define compressible flow and incompressible fluid. Must the flow of a compressible fluid necessarily be treated as compressible?

3- Define stress, normal stress, shear stress, and pressure.

4- Fluids at rest cannot resist a shear stress. Explain with examples.

5- Distinguish between vapor and gas.

6- When is a system a closed system, and when is it a control volume?

7- What is a steady flow, uniform flow, and periodic flow process?

8- What is the importance of modeling in engineering?

9- Provide and discuss examples of fluid mechanics engineering applications. List four differences between liquids and gases. Give examples for each matter.

10- A number of common substances are: **Tar - Sand - Silly Putty - Jello - Modeling clay - Toothpaste - Wax - Shaving cream - Ketchup - Ghazien - Wall Paint**. Some of these materials exhibit characteristics of both solid and fluid behavior under different conditions. Explain.